# 6 – Rolling Dip

## Definition

Rolling dips are a cross between a water bar and a broad-based dip. Like broad-based dips, they have a reverse grade (although shorter) and direct water off the road. Like water bars, they may rely on a mound of soil at the downhill side. Rolling dips should be used on roads with a grade steeper than where a broad-based dip is used.

## Purpose

To gather water and direct it safely off the road to prevent buildup of surface runoff and subsequent erosion, while allowing the passage of traffic.

## Conditions Where Practice Applies

- Used on truck haul roads and heavily-used skid trails having a gradient of 15% or less. Should not be used for crossing streams, springs, and seeps.

## Recommended Specifications

- Installation follows basic clearing and grading for roadbed construction or on skid trails after logging is completed.
- A 10-15 foot long, 3% to 8% reverse grade is constructed into the roadbed by cutting upgrade to the dip location and then using cut material to build the mound for the reverse grade.
- In hills, rolling dips are located to fit the terrain as much as possible. They should be spaced according to the slope of the planned roadbed.

**Table 12**
**Recommended Rolling Dip Spacing**

| Road Grade (percent) | Distance Between Dips (feet) |
|---|---|
| 2-5 | 180 |
| 5-10 | 150 |
| 10-15 | 135 |
| 15+ | 120 |

# 7 – Water Bar

## Definition

A diversion dam constructed across a road or trail to remove and disperse surface runoff in a manner that adequately protects the soil resource and limits sediment transportation.

## Purpose

To gather and shed surface water off a road, firebreak, trail, etc.; prevent excessive erosion until natural or artificial revegetation can become established; and to divert water from an inside (uphill) ditch.

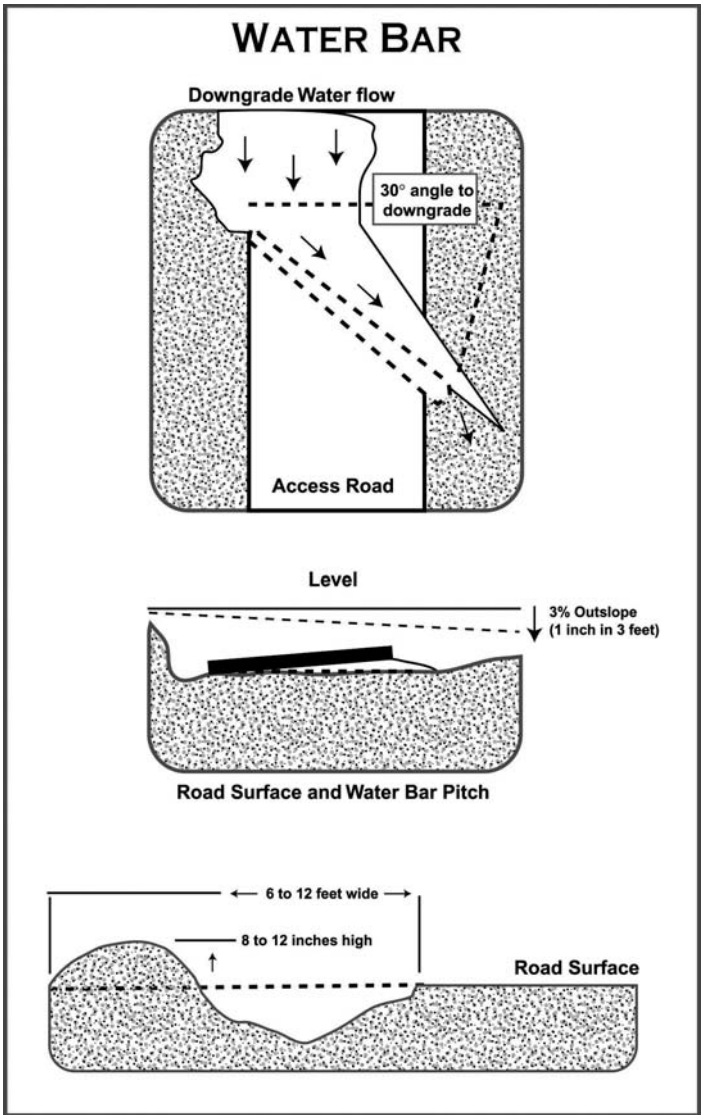
## Conditions Where Practice Applies

- This is a practice that can be used on limited-use roads, trails and firebreaks. It is an excellent method of retiring roads and trails as well as abandoned roads where surface water runoff may cause erosion of exposed mineral soil.

## Recommended Specifications

- Water bars should be placed at an angle of 30 to 45 degrees to the road, firebreak or trail. Water bars are *not* dams. Water bars intercept and/or divert surface water runoff.
- The outflow end of the water bar should be fully open and extend far enough beyond the edge of the road or trail to safely disperse runoff water onto the undisturbed forest floor. The outlet should fall no more than 2%.
- The uphill end of the water bar should be tied into the cutbank of the road or trail, or into the upper bank of the road or trail.
- Specifications for water bar construction on forest roads, trails and firebreaks must be site specific and should be adapted to existing soil and slope conditions.

| Table 13<br>Recommended Water Bar Spacing | |
|---|---|
| Road Grade (percent) | Distance Between Water Bars (feet) |
| 2 | 250 |
| 5 | 135 |
| 10 | 80 |
| 15 | 60 |
| 20 | 45 |
| 30 | 35 |



# 8 – Temporary Fill Diversion

## Definition

A channel with a supporting ridge of soil on the lower side, constructed along the top of an active earth fill.

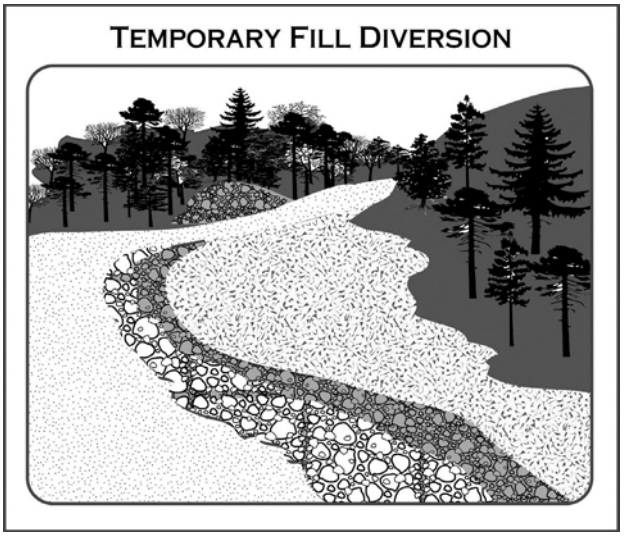
## Purpose

To divert storm runoff away from the unprotected slope of the fill to a stabilized outlet or sediment-trapping condition, whether the sediment trapping is natural or manmade.

## Conditions Where Practice Applies

- Where the drainage area at the top of an active "earth fill" slopes toward the exposed slope and where other drainage structures cause the fill to erode during and after construction of haul roads, log decks, skid trails, etc. The temporary fill diversion is used where other diversions are not feasible during construction of haul roads, log decks, etc. This temporary structure should remain in place for the period of active harvesting.

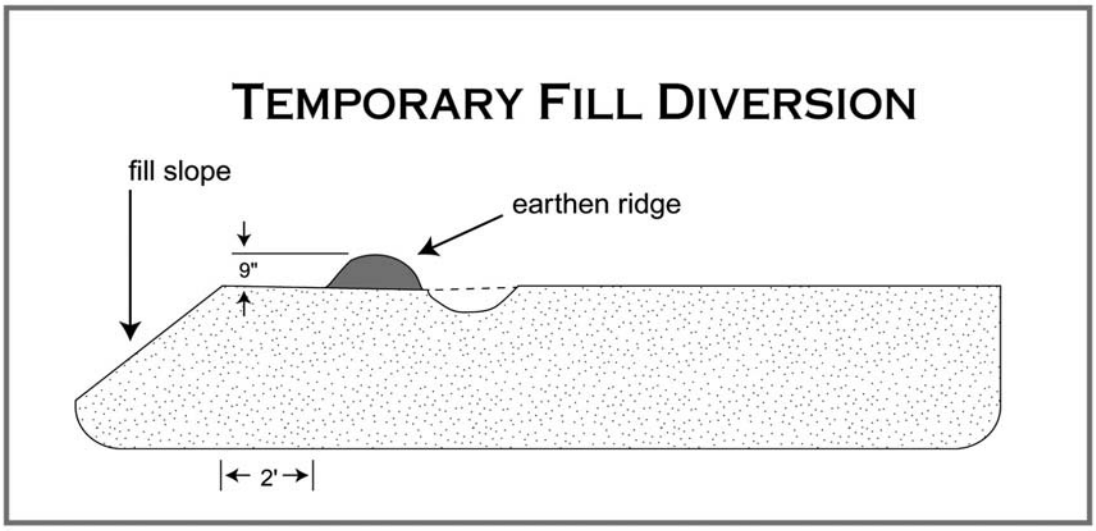
## Planning Considerations




On rare occasions a road, skid trail, or log deck is installed on steep slopes where the construction of such roads and decks may take several days. This is not a good BMP and should be avoided when other alternatives are available. One important principle of the BMPs is to keep stormwater runoff away from exposed slopes. This can be accomplished by installing a dike, diversion, temporary slope drain or, if the road is to be permanently maintained after harvest, a vegetated or lined ditch may be appropriate to carry the runoff away from the slope to a stabilized outlet. In general these measures may be installed after the

final grade has been reached. On cuts, the measures may be installed at the beginning since the work proceeds from the top to the bottom of the slope, and the measures have little chance of being covered or damaged. On cuts, the work proceeds from the bottom to the top and the elevation changes daily until the final grade is reached (it is rare that a silvicultural operation will require such extreme excavation). It is, therefore, not feasible to construct a compacted dike or permanent diversion that may be covered by the next day's grading.

The temporary fill diversion is intended to provide some slope protection on a daily basis until final elevations are reached and a more permanent measure can be constructed. This practice can be constructed by the use of a motor grader or a small dozer. To shape the diversion, the piece of machinery used may run near the top edge of the fill with its blade tilted to form the channel. This work would be done at the end of the workday and provide a channel with a berm to protect the slope. Wherever possible, the temporary diversion should be sloped to direct water to a stabilized outlet. If the runoff is diverted over the fill itself, the practice may cause erosion by concentrating water at a single point.



# 9 – Temporary Slope Drain

## Definition

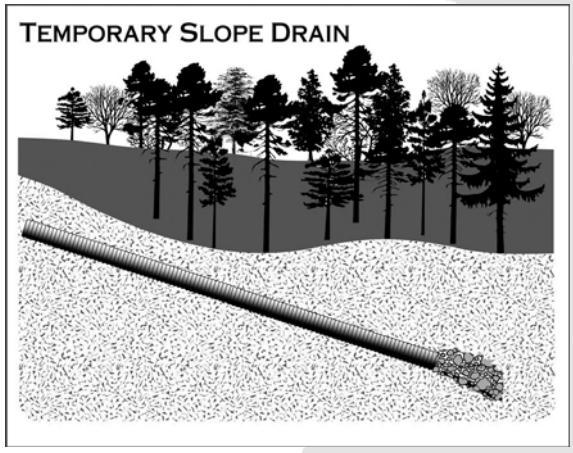
A flexible tubing or conduit extending from the top to the bottom of a cut or fill slope.

## Purpose

To temporarily conduct concentrated stormwater runoff safely down the face of a cut or fill slope without causing erosion on or below the slope.

## Conditions Where Practice Applies

- On cut or fill slopes where there is a potential for flows to move over the face of the slope causing erosion and preventing adequate stabilization.
- There is often a significant lag between the time a cut or fill slope is completed (on truck haul roads, log decks, skid trails, etc.) and the time a temporary or permanent drainage system can be installed or permanent vegetation established. During this period, the slope is usually not stabilized and is particularly vulnerable to erosion. This situation also occurs on slope construction that is temporarily delayed before final grade is reached. Temporary slope drains can provide valuable protection of exposed slopes until temporary or permanent drainage structures can be installed or vegetation can be established.



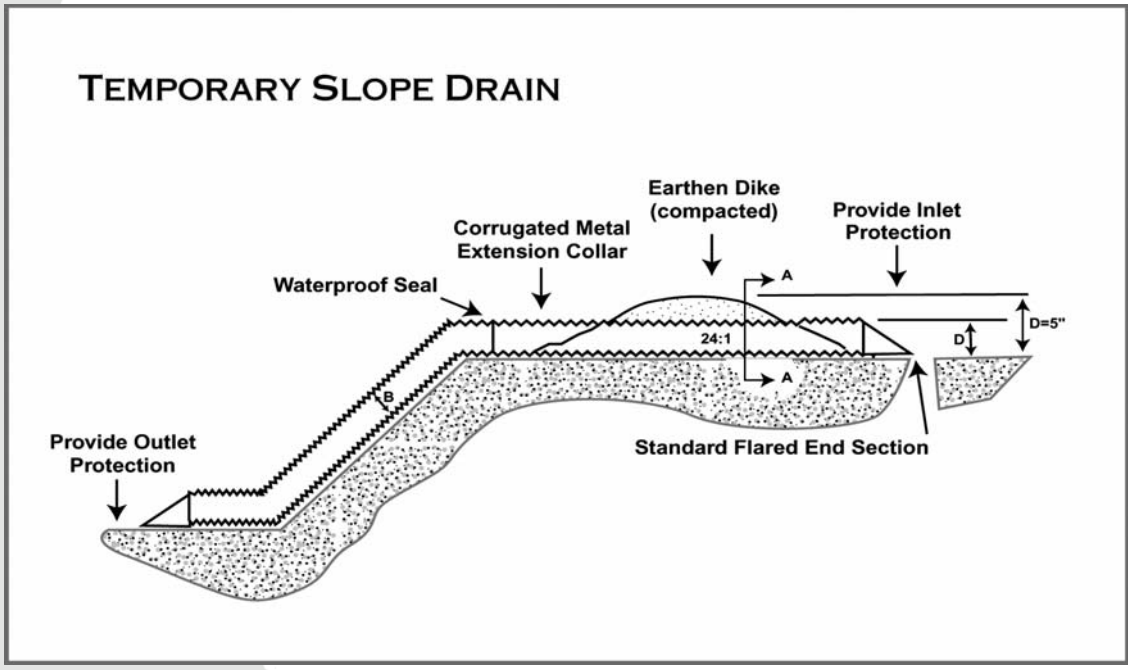

Temporary slope drains can be used in conjunction with diversion dikes to convey runoff from the entire drainage area above a slope to the base of the slope without erosion. It is very important that these temporary structures be installed properly as their failure will often result in severe gully erosion on the site and sedimentation below the slope. The entrance section must be securely entrenched, all connections should be watertight, and the conduit must be staked securely.

## Drainage Area

The maximum recommended drainage area per slope drain is 5 acres.

## Flexible Conduit

The slope drain should consist of heavy-duty, flexible material designed for this purpose. The diameter of the slope drain should be equal over its entire length. Reinforced hold-down grommets should be spaced at 10-foot (or less) intervals.




## Recommended Construction Specifications

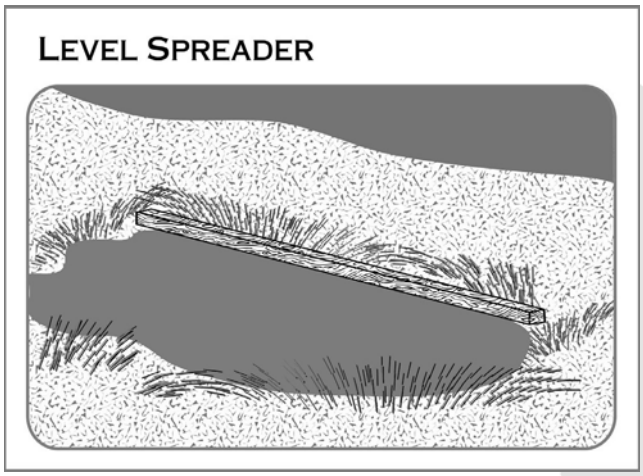
- The measure should be placed on undisturbed soil or well-compacted fill.
- The entrance section should slope toward the slope drain at the minimum rate of ½ inch per foot.
- The soil around and under the entrance section should be hand-tamped in 8-inch lifts to the top of the dike to prevent piping failure around the inlet.
- The slope drain should be securely staked to the slope at the grommets provided.
- The slope drain sections should be securely fastened together and have watertight fittings.
- Properly install culvert inlet protection and outlet protection.

The slope drain structure should be inspected weekly and after every storm, and repairs made if necessary. The logger should avoid the placement of any material on, and prevent logging traffic (including skidding) across, the slope drain.

# 10 – Level Spreader

## Definition

An outlet for drainage structures and diversions consisting of an excavated depression constructed at zero grade across a slope.




## Purpose

To convert concentrated runoff to sheet flow and release it uniformly onto areas stabilized by existing vegetation.

## Conditions Where Practice Applies

- Where there is a need to divert stormwater away from disturbed areas such as log truck haul roads, log decks, skid trails, etc. to avoid overstressing erosion control measures; and where sediment-free storm runoff can be released in sheet flow down a stabilized slope without causing erosion.

This practice applies only in those situations where the spreader can be constructed on undisturbed soil and the area below the level lip is uniform with a slope of 10% or less and is stabilized by natural vegetation. The runoff water should not be allowed to re-concentrate after release.

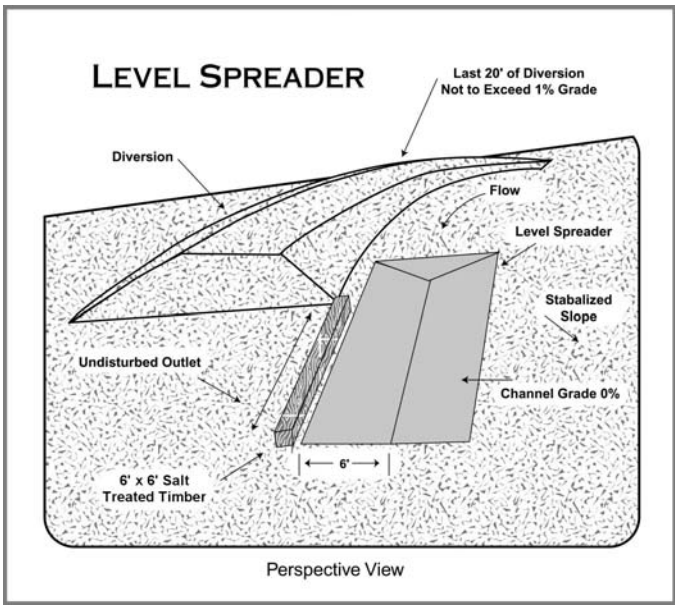
## Planning Considerations

Diversions installed in haul roads and skid trails should have stable outlets for concentrated stormwater flows. The level spreader is a relatively low-cost structure designed to release small volumes of concentrated flow where site conditions are suitable and there is a need to spread the runoff to prevent channeling.

The outlet area must be uniform and well vegetated with slopes of 10% or less. Particular care must be taken to construct the outlet lip completely level in a stable, undisturbed soil. Any depressions in the lip will concentrate the flow, resulting in erosion.

## Recommended Construction Specifications

- Level spreader should be constructed on undisturbed soil (not fill material).
- The entrance to the spreader should be shaped in such a manner as to insure that runoff enters directly onto the 0% channel.
- Construct a 20-foot transition section from the diversion channel to blend smoothly to the width and depth of the level spreader.
- The level lip should be constructed at 0% grade to insure uniform spreading of storm water runoff.
- Protective covering for vegetated lip should be a minimum of 4 feet wide and extending 6" deep in a vertical trench on the lower edge. The upper edge should butt against smoothly cut sod and be held securely in place with closely spaced heavy-duty wire staples.
- Rigid level lip should be entrenched at least 2" below existing ground and be securely anchored to prevent displacement. An apron of VDOT #1, #2, or #3 Coarse Aggregate should be placed on top of level lip and be extended down slope at least 3 feet. Place filter fabric under stone and use galvanized wire mesh to hold stone securely in place.

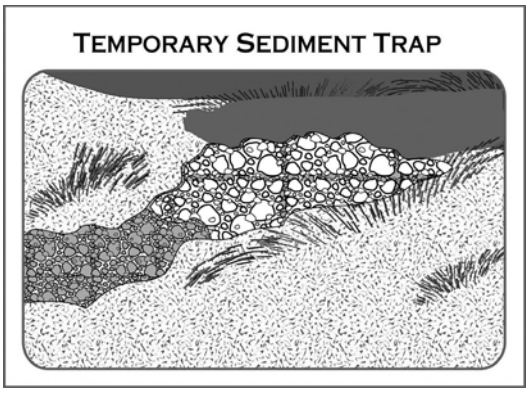



- The released runoff must outlet onto undisturbed stabilized areas with slope not exceeding 10%. Slope must be sufficiently smooth to preserve sheet flow and prevent flow from concentrating.
- Immediately after its construction, appropriately seed and mulch the entire disturbed area of the spreader.

## Maintenance

The measure should be inspected after every rainfall and repairs made, if required. Level spreader lip must remain at 0% slope to allow proper function of measure. The operator should avoid the placement of any material on, and prevent logging traffic across, the structure. If the measure is damaged by logging traffic, it should be repaired immediately.

# 11 – Temporary Sediment Trap




## Definition

A temporary ponding area formed by constructing an earthen embankment with a stone outlet.

## Purpose

To detain sediment-laden runoff from small disturbed areas long enough to allow the majority of the sediment to settle out.

## Conditions Where Practice Applies

- Below disturbed areas where the total contributing drainage area is less than 3 acres.
- Where the sediment trap will be used not longer than 18 months (the maximum useful life is 18 months).
- The sediment trap may be constructed either independently or in conjunction with a temporary diversion dike.

Rarely is the Temporary Sediment Trap used or needed in silvicultural operations. Proper pre-harvest planning will, in most cases, eliminate the need for such structures. Changing land use from silvicultural to development, for example, may require installation of such control structures if grading or stumping is performed during harvest. A soil disturbance permit may be required and can be obtained from the county or city when certain soil disturbing activities take place. It is most cost efficient and environmentally correct to plan temporary and permanent stabilization to suit the intended land use.

Sediment traps should be constructed as a first step in any land clearing activity expected to be 10,000 square feet contiguous or more (examples are log decks, haul roads, or skid trails that cannot be properly drained and filtered otherwise). Sediment traps should be made functional before upslope land disturbance takes place.

A properly constructed sediment trap will remove 60% or more of the sediment during large storm events. To achieve this rate, the sediment trap must have adequate storage volume. There are both a "wet" storage volume and a draw down or "dry" storage volume that helps to enhance sediment fall-out and prevent excessive sediment losses during large storm events that occur during advanced stages of land disturbance.

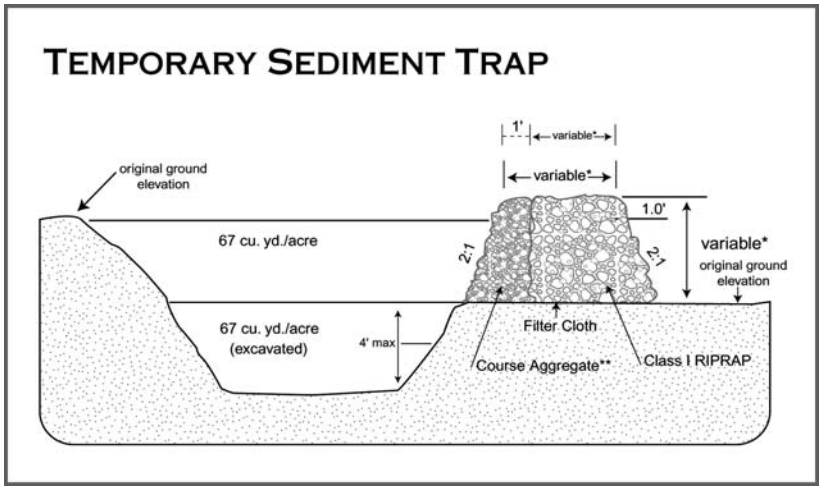
In most cases excavation will be required to attain the necessary storage volume. Sediment must be periodically removed from the trap to maintain the required volume. Plan to properly dispose of and stabilize excavated sediment.

There are a number of acceptable ways to design many of the BMP structures and this is true in the case of the sediment trap. However, variations in design should be considered by an engineer to ensure that the minimum storage requirements and structural integrity noted in this specification are maintained.

## Trap Capacity

The sediment trap must have an initial storage volume of 134 cubic yards per acre of drainage area, half of which should be in the form of a permanent pool or wet storage to provide a stable settling medium. The remaining half should be in the form of a draw down or dry storage that will provide extended settling time during less frequent, larger storm events.

The volume of the wet storage should be measured from the low point of the excavated area to the base of the stone outlet structure. The volume of the dry storage should be measured from the base of the stone outlet to the crest of the stone outlet (overflow mechanism). Sediment should be removed from the basin when the volume of the wet storage is reduced by one-half.




Calculation of the sediment trap should be done by a forest engineer or civil engineer.